Waveform Data Acquisition Lab

Objectives

- To understand the concept of the “Sampling Theorem”
- To understand the meaning of aliasing
- To familiarize students with data acquisition concepts
- To gain experience with LabVIEW.

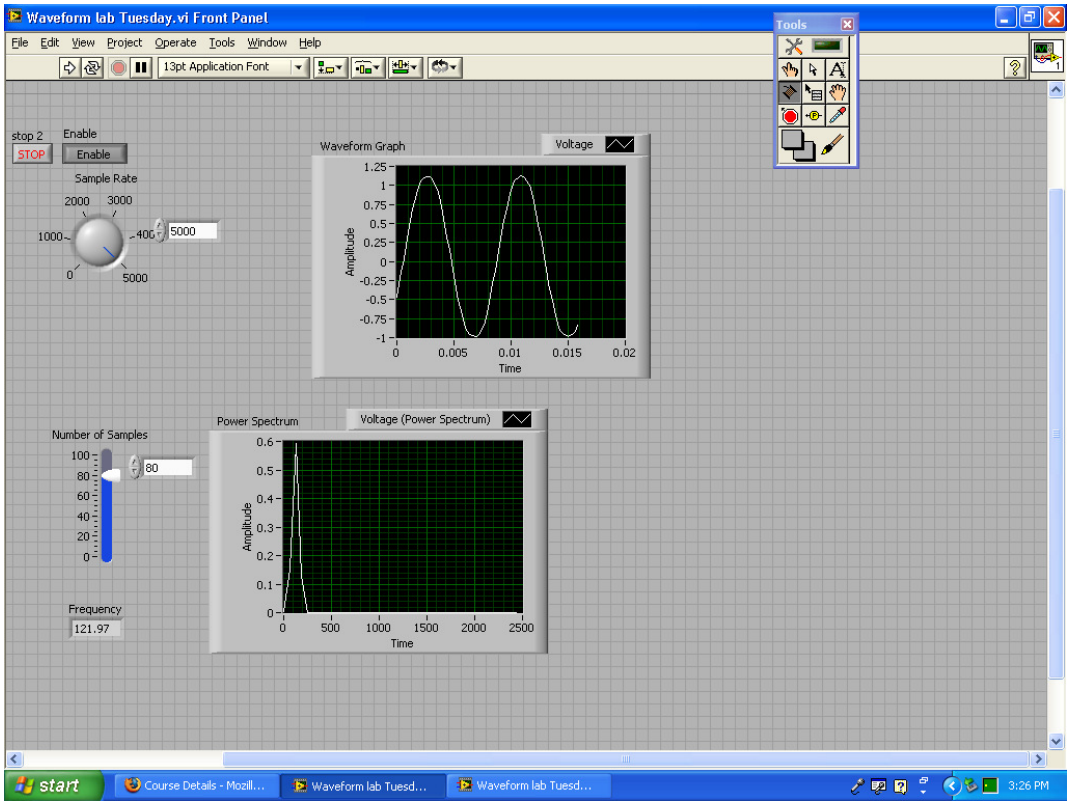
Required Materials

- National Instruments DAQ signal accessory (PN 77382-01)
- National Instruments PCI-6024E multifunction DAQ board

Procedure

Exercise 1

1. Open LabVIEW 8.2
2. Select build new LabView VI on main screen.
3. Before creating the LabVIEW program attach a wire from the sine wave output to the channel 1 input on the DAQ board.
4. Create Front Panel and block diagram as shown in Figure 1.



a. Right click front panel and select Numeric then Dial. Label the dial as “Sample Rate”. Right click on the largest number and change value to 5000.
b. Create a numeric vertical pointer slide. Right click on the front panel and select Numeric then Vertical Pointer Slider. Change scale to 100 the same way as in previous step.
c. Add a numeric indicator and label as frequency.
d. Create two waveform graphs by right clicking on the front panel and selecting the graphs tab then selecting waveform graphs.
e. Label one graph “Sample Waveform” and the other “Power Spectrum”
f. Front Panel is complete.

5. Organize the block diagram in an easy to read way (use Figure 2 as a guide)

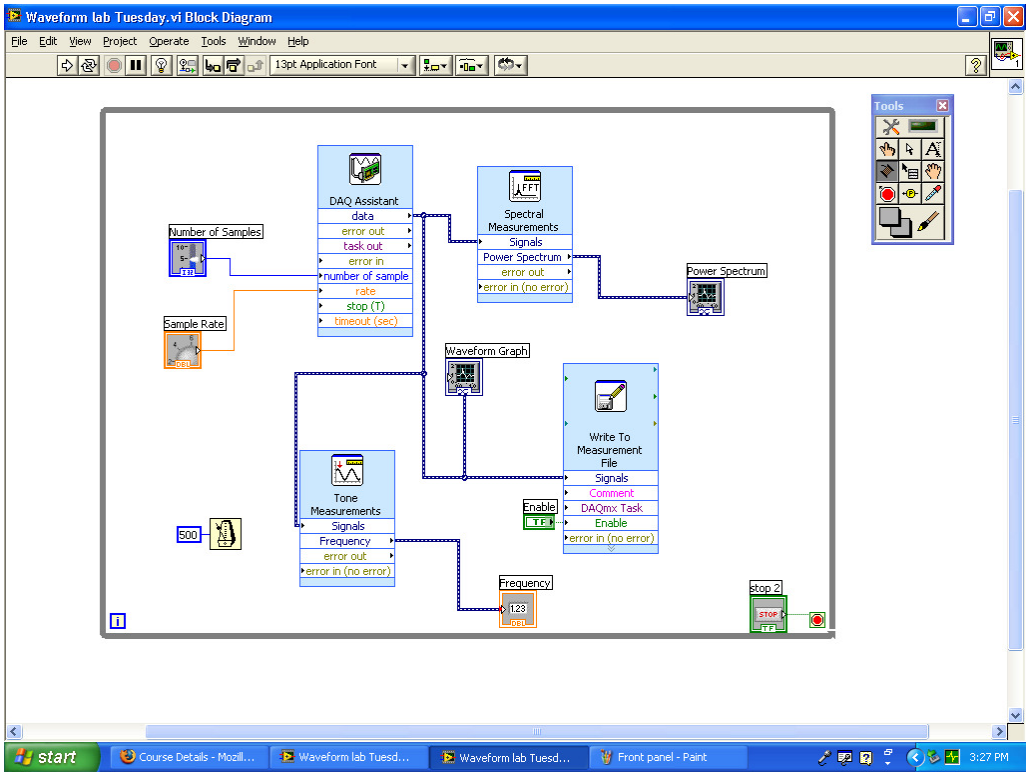


Figure 2. Example of the block diagram.

a. Right click and select Express then Input then DAQ Assistant.
    i. When DAQ initialization screen opens double click on voltage which is under analog input. Select channel ai1.
    ii. On the screen that comes up after the channel is selected change the rate to 5k (initially at 1k).
b. Use the wiring tool to connect the “Number of Samples” numeric vertical pointer slider to number of samples on the DAQ assistant. Then connect the “Sample Rate” indicator to the rate on the DAQ assistant.
c. Create a Spectral Express VI
    i. Right click then go to Express then Signal Analysis then select Spectral
    ii. Select Power Spectrum and linear in the Spectral Measurement box.

d. Connect the DAQ assistant Data to Signals on the Spectral Express VI.
e. Then connect the Power Spectrum terminal on the Spectral Measurement VI to the power spectrum waveform graph.
f. Open a Tone Measurements VI
    i. Select Express then Signal Analysis then Tone Measurements
    ii. Unselect amplitude and select frequency
g. Wire from the data terminal from the DAQ assistant to the signals terminal on the Tone Measurement Express VI.
h. Create a Write to Measurement file and save it where you can locate it later.
    i. In the options for Write to Measurement file select Save to one file, Rename existing file, text, one header only, one column only.
    ii. On block diagram right click the enable terminal and select create then control.
i. Create a while loop around entire program.
    i. Right click the back panel and select Structures then While Loop.
    ii. Right click on loop condition and create a control.
j. Wire data terminal from DAQ assistant to "Sampled Waveform" Waveform graph. Then wire the DAQ assistant data terminal to the Write to Measurement file Express VI signals terminal.
k. Create a timer.
    i. Right click then select Timing then select Wait Until Next ms Multiple.
    ii. Right click on the timer function and create a constant
    iii. Set the constant as 500 and wire the constant to the timer.

Exercise 2

Modify the program from exercise to do the following:

1. Add a while loop around the DAQ assistant VI
    a. Inside the while loop add a timer function with an integer constant of 300.
    b. Add a Boolean function attached to the stop condition and label it "Take Data".
    c. Add a case structure that will allow the program to keep track of how many times the take data button is pushed. For case 0 (not shown in picture) simply replace the counter indicator with a constant with value 0.
2. On the outer while loop add a shift register by right clicking on the while loop.
3. At the beginning of the program wire the shift register to an array function that will take each data set and add it to the array and will then send it to the write measurement file each time the take data button is pushed.
4. When you run the program press the take data button in order to record a data set. If the take data button is not pushed then no data will be recorded.

For help with setting up the front panel and block diagram refer to figures 3 and 4 below.

The report should include the plots of the aliased and unaliased data on the same graph (with the use of excel).

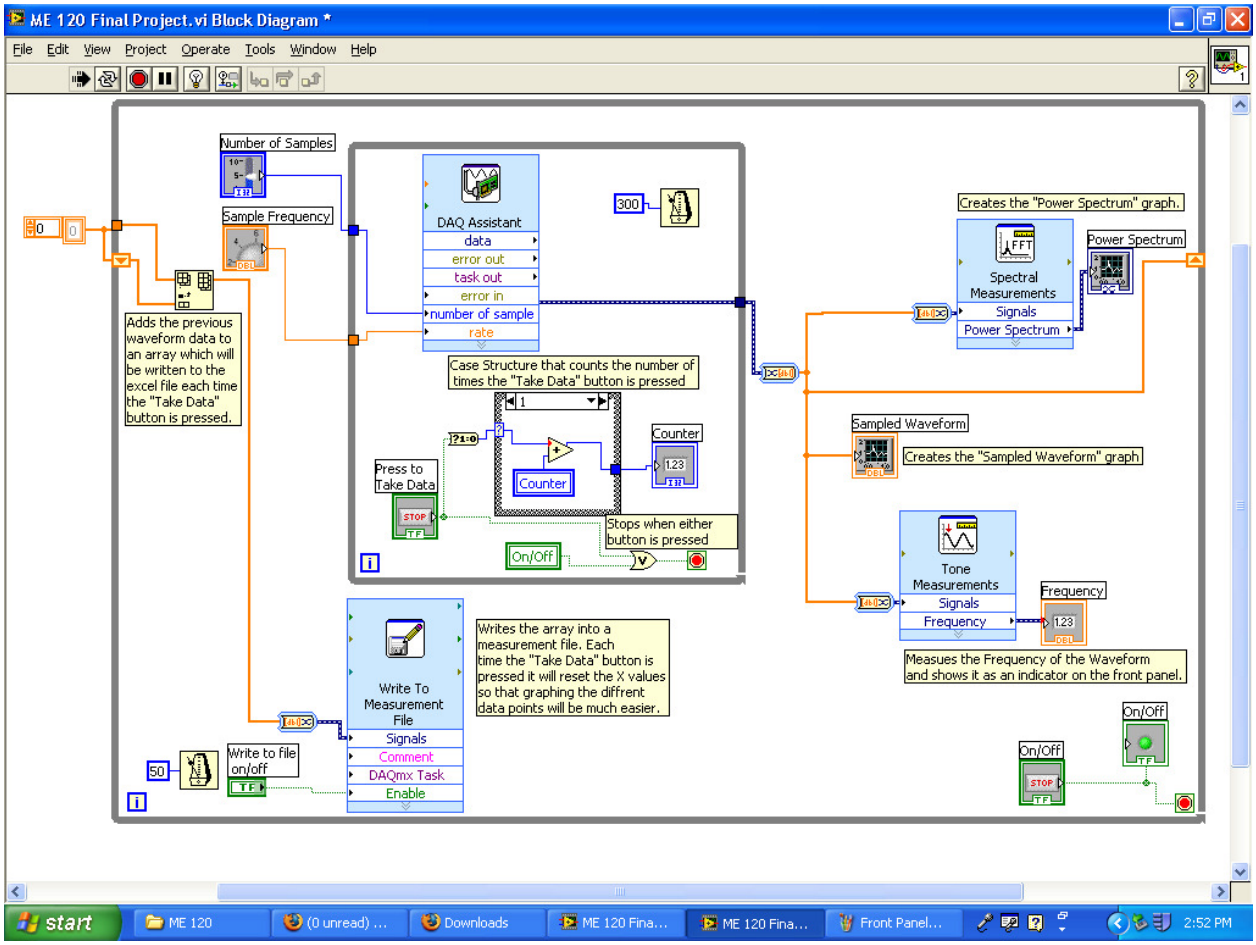


Figure 3. Block diagram for exercise 2.

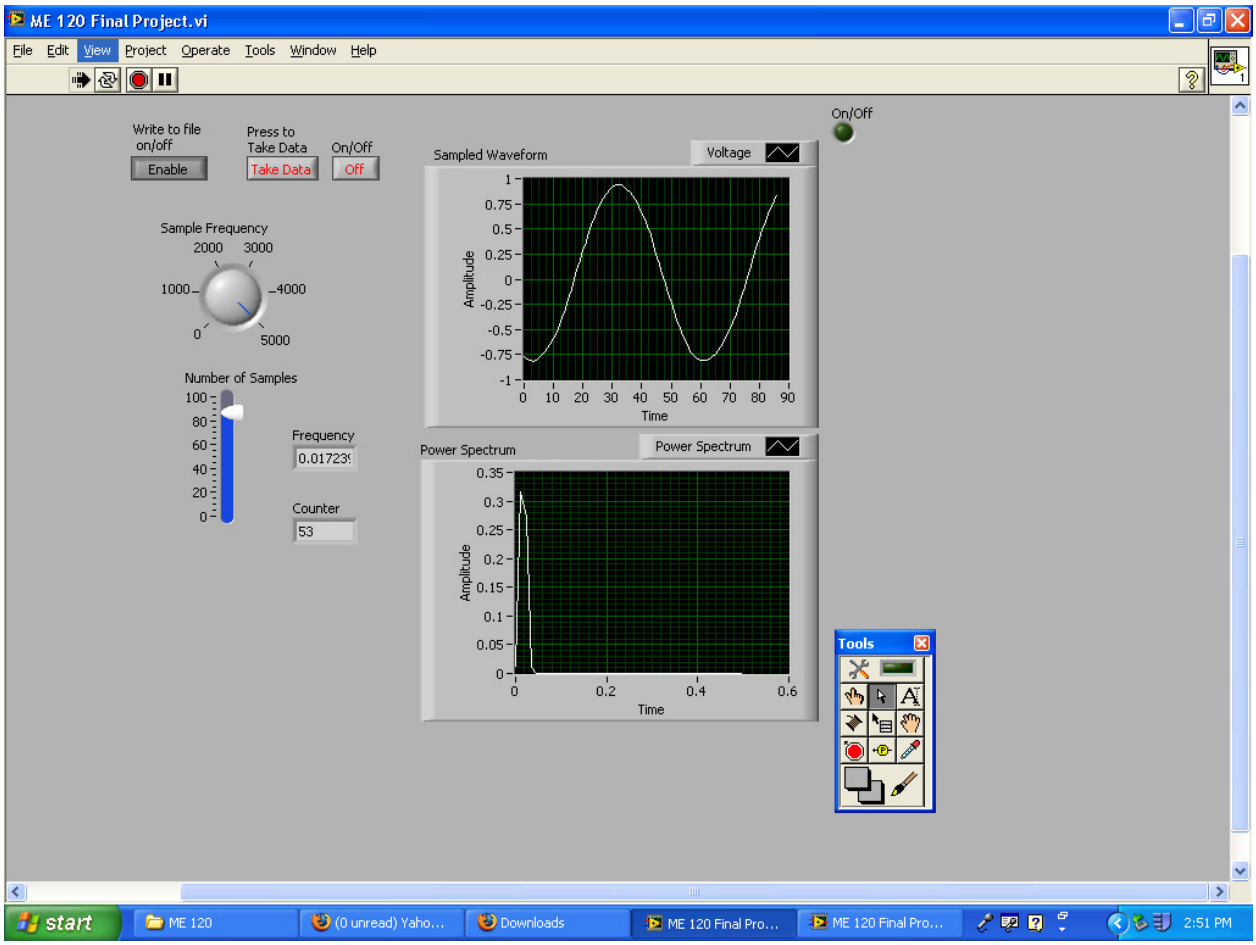


Figure 4. Front panel for exercise 2.

References

1. Merlin, Dan. “Waveform Data Acquisition Experiment” ME 120 Experimental Methods. San Jose State University, San Jose. 29 September 2009.
2. Raul, Sudeep. “Waveform Data Acquisition Experiment” ME 120 Experimental Methods. San Jose State University, San Jose. 11 September 2009.
3. Furman, Burford J. “Waveform Data Acquisition Experiment” ME 120 Experimental Methods. San Jose State University, San Jose. Unknown Date.